Environment Canada Environnement Canada Conservation and Protection

ASSESSMENT OF WASTE REDUCTION OPPORTUNITIES FOR INK AND PAINT MANUFACTURING

TECHNICAL ASSISTANCE PROJECT

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PLANT A

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PLANT A

1 PLANT DESCRIPTION

The plant produces a wide variety of solvent-based paints for architectural, automobile, and general consumer applications. No water-based paints are manufactured.

1.1 Raw Materials Management

The raw materials used include solvents, resins, pigments, extenders and miscellaneous as listed in Table 1. The pigments are delivered in bags and used in powder form. Solvents are either delivered and stored in drums or delivered in bulk and held in aboveground, undyked storage tanks.

Solvents are used to disperse the resin binder and pigments in a homogeneous mixture. Pigments provide paints with color and offer opacity to shield the resin binder from ultraviolet degradation. Resins are used for binding the pigments and film formation after the solvents have evaporated. Extenders are added to improve weathering properties.

Surfactants and defoamers serve as wetting agents to lower surface tension so as to disperse the pigments in the resins, and to produce a uniform film. In addition, defoamers help avoid or minimize bubble formation during mixing, filling, or brush application. Since the paints are solvent-based no bactericides or fungicides are needed. Raw materials are held in one of the operation rooms.

Inventory: This company has card and paper files, and computerized inventory systems for its raw materials and products. The computerized system is used to track input and output of materials on a daily basis. The paper and card files are used to keep track of the long-term (yearly) supply and usage trends.

Workplace Hazardous Material Information System (WHMIS): The plant management is aware of WHMIS and is in the process of implementing it. It appears that some outside assistance/training is needed.

Table 1

Raw Materials Used in Plant A

Description	Material
Solvents	.Ketones .Aromatics .Alcohols .Methyl ethyl ketone
Resins	.Epoxy resins .Polyurethane resins
Pigments	.Titanium dioxide .Yellow pigment (yellow oxide) .Red pigment (containing red lead, Pb_3O_4) .Organic pigments
Extenders	.Clay .Talc ($H_2Mg_3(SiO_3)_4$)
Miscellaneous additive	.Surfactants and defoamers (wetting agent) .Ammonia .Viscosity modifier .Plasticizers

1.2 Blending Process

1.2.1 Blending of Additives

There are 3 ball mills (2 operational, 1 new but not yet in use), 2 sand mills and 1 bead mill. The purposes of the mills are:

- To wet the pigment surface
- To separate the pigment clusters into primary (less than 2 um) and agglomerate (1-30 um) particles
- To disperse the pigments and other ingredients throughout the resin
- To stabilize so that the particles do not flocculate into larger ones

These four functions take place simultaneously.

Bead Mill: The bead mill is a horizontal open type using spherical ceramic beads as grinding media. Solvent and other components are poured into the mill where they undergo a 15-hour grinding. Every operation cycle produces 30 gallons of paint. A small container is placed at the mouth of the mill as a drip pan to catch some of the evaporated solvent. The trapped and condensed solvent in the container is recycled to the system. The heat generated by friction is removed by cooling water which is reused.

Sand Mill: The sand mill is a sealed, vertical media mill using sand as the grinding media. The mill has a stuffing box around the shaft and an enclosed screen. The enclosed screen prevents solvent evaporation, eliminating the problem of solvent emissions encountered by the open bead mill.

Components including solvent are premixed in a drum using a mixer and poured into a sand mill for a total of 8-hour rotation. The mixture in the mill undergoes 4 passes for every batch of concentrated paint produced, each pass taking two hours. Heat generated due to friction is removed by cooling water. The plant indicated that cooling water is reused.

Ball Mill: A ball mill is a rotating cylinder filled with media, such as rocks or steel balls to pulverize and enhance mixing during rotation.

This plant has three ball mills. Each mill is filled with about 2000 lbs of small rocks of irregular shape. The operator pours the solvent and other components into the mills. They are sealed, and then allowed to rotate for a prespecified period of time. The mixture is then discharged into a mobile, 140-gallon, mixing and dispersion tank (Fig. 1).

Ball Mill No. 1 runs for 50 hours per batch; Ball Mill No. 2, 70 hours per batch. The batch produced from Ball Mill No. 1 is used for primary pigment shades or single pigment dispersion, such as titanium dioxide. Ball Mill No. 2 is used for producing black paint only. Spent solvents are often recycled to be used here. Ball Mill No. 3 had no specific function at the time of the field assessment. No cooling is applied to ball mills.

1.2.2 Paint Blending and Thinning

This plant blends its paints using either a one- or two-stage process. In a two-stage process basic ingredients are first blended with resin carrier in a mill as described in Section 1.2.1 before the mixture is transferred or pumped to a large dispersion cylinder (140-gallon) to be thinned with solvent (Fig. 1). In a one-stage process the blending of the additives and the thinning of the mixture are carried out simultaneously in a high speed dispersion tank (Fig. 2).

The plant has many mobile, high speed dispersion tanks of various sizes (Table 2). A high speed dispersion tank is a cylinder, that can be equipped with a rotating blade for pigment mixing operations.

Figures 1 and 2 illustrate the production of solvent-based paints in this plant.

Table 2

Holding/Filling, Mixing/Dispersion Tanks- Plant A

Capacity (gallons)	Number of Tanks	Mobile	Stationary
Holding/Filling Tanks			
40	32		x
40 (standby)	32	x	
Mixing/Dispersion			
140	3	x	
250	2	x	
500	2		x

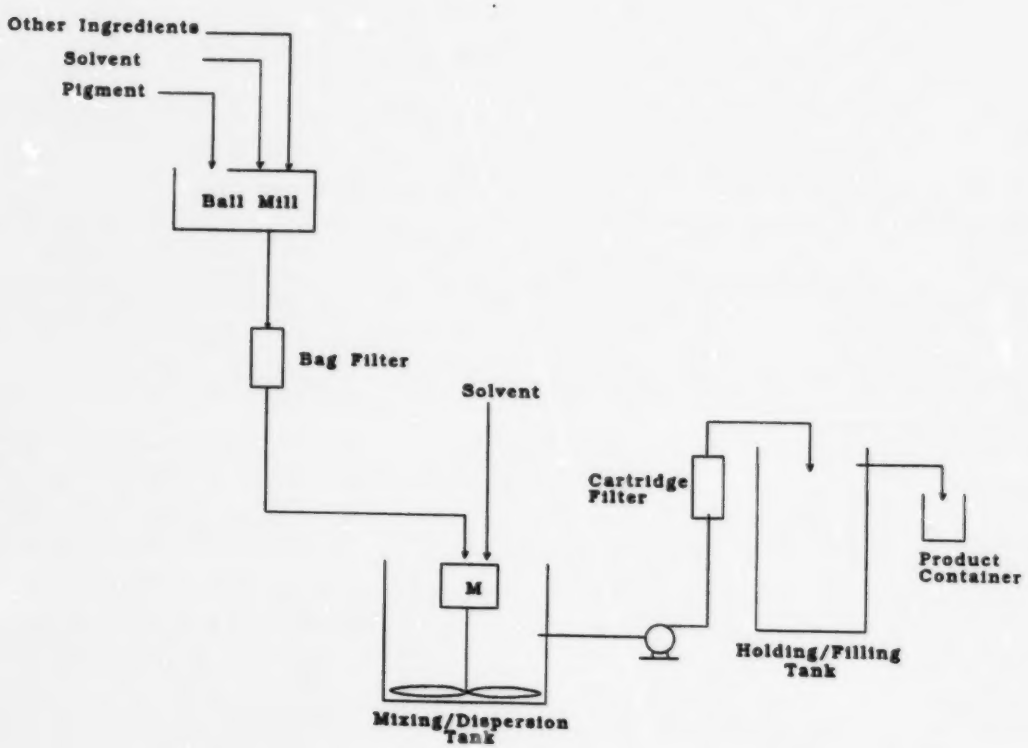

Fig. 1 Flow Diagram of Two-Stage Process of Paint Formulating- Plant A

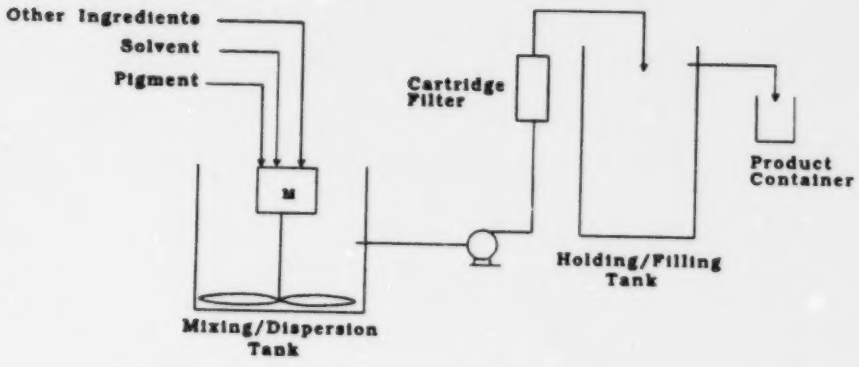

Fig. 2 Flow Diagram of One-Stage Process for Paint Formulating- Plant A

1.2.3 Filling Line

After the ingredients have been blended and thinned to specifications, the mixture is transported to holding/filling tanks. The plant has 64 holding/filling tanks, of which half are mobile. Each tank carries a base shade of paint. A manual filling and mixing system is sitting on a rail track along the row of the holding tanks. An operator uses a "recipe" of sorts to mix the shades of paint from the holding tanks. The "recipe" provides the operator with information on how much of each base shade of paint to put into a small container to make the required shade.

1.3 Cleaning Operations

Bag and cartridge filters are used to remove undispersed solids, skin, scale and other contaminant particles from paints.

Cartridge filters having pore sizes ranging from 10 ~ 15 mu are used in the filling line and spent solvents/thinner pump. Bag filters have pore size about 50~0 mu and are used in ball mills.

In general, tanks and equipment are solvent-cleaned, but the plant does not clean its mills after each operation. The plant manages to produce all the primary single dispersion colors by using equipment dedication; and the blending of similar color paints in a particular mill to reduce cleaning frequency.

1.4 Waste Management

The major waste streams produced by this plant include the follcwing:

- o Empty drums, bags
- o Spent solvent
- o Spills
- o Spent filters

Empty drums are rinsed, then crushed and sent to recyclers. Empty bags, and other paper are thrown in the garbage bin.

Solvent is used to clean machine parts. The spent solvent, after being filtered through a cartridge, is utilized in the next compatible batch of paint formulation in the ball mill. Solvent sludge is disposed of in a garbage bin.

Bag filters are made of polypropylene, which is resistant to shedding, tearing, rupturing or disintegrating. Because of these features, ball mill filters are solvent-washed and reused many times until totally worn out; filters used in spent solvent pumps are replaced twice a week. All bag filters are finally discarded in the garbage bin after having been solvent-rinsed.

There are 32 filters in the filling line. Each cartridge filter lasts about two months before replacement. The spent cartridge filters are then dumped in the garbage bin.

2 GENERAL OBSERVATIONS

(1) On the floor near the mills, the blending and the storage areas and on the cardboard near the holding/filling tanks, spillage and dust were evident.

(2) The cooling water from the bead and sand mills was recycled back to the cooling system through a heat exchanger.

(3) The plant staff indicated that they had not experienced any out-of-date materials in the past.

(4) Spills were swept up if they were in powder form, or mopped up using solvent if liquid.

(5) The plant did not see the need for a spill contingency plan. However, the manager expressed his interest in obtaining a list of emergency phone numbers for use in case of a major spill/accident.

(6) The plant uses regular air filters to filter the air intake, but does not filter the air leaving the plant.

(7) Solvent was emitting from the open bead mill.

3 RECOMMENDATIONS

Based on the foregoing information provided by the plant and that obtained from field assessments, we have made the following suggestions to improve the plant operations to minimize waste generation. Rationales leading to some of the recommendations have been described immediately following their corresponding recommendations.

Recommendation 1
Provide brooms and collection equipment near where the pigment or dust is handled.

Recommendation 2
Expand the computerized inventory system to include waste.

Establish to track when, what and how much waste is generated by each step of the process. Expanding the inventory system to wastes (waste streams and their generation rates) will help realize benefits in terms of waste reduction.

Recommendation 3
Keep solvent sludge and pigment bags out of the garbage bin.

Keeping hazardous wastes apart from non-hazardous wastes.

Recommendation 4
Keep inventory of raw materials and products to a minimum

This will reduce the likelihood for out-dated materials.

Recommendation 5
Sort bags used for containing innocuous materials such as clay, and sell them to paper recyclers.

Recommendation 6
Exercise operational care, such as:

- **Care and attention in transport of raw materials from storage to point of use**
- **Care and attention of moving finished products to storage or to shipping point.**

These are effective measures for reducing waste from finished products and raw materials.

Recommendation 7
Remove as much wet paint as possible by scraping before solvent-cleaning process vessels.

Recommendation 8
Avoid paint drying in process vessels.

It is desirable to avoid dry paint scaling by cleaning the vessel immediately after use, or adding a small quantity of solvent into the vessel. The latter needs some coordination between production and cleaning.

Recommendation 9
Use high pressure spray cleaning.

High pressure spray cleaning systems are commercially available. The use of a high pressure spray cleaning system is more economical than solvent wash.

Recommendation 10
Avoid unnecessary cleaning

Maximizing the dedication of a piece of equipment to one formulation or operation can avoid the need of cleaning or reduce cleaning frequency.

Recommendation 11
For cleaning purposes, use solvent which is compatible for thin-down formulation.

Recommendation 12
Apply dry cleaning to spills.

Clean up spills by dry means rather than solvent cleaning or flushing with water.

Recommendation 13
Use slurried pigments instead of powdered pigments

Dusts are generated when powder is sampled in the weighing area, or added to a mixing vessel. The use of slurried pigments will avoid the problem. Slurried pigments may be purchased directly from their manufacturers.

Recommendation 14
Segregate waste paper from other dry garbage and give or sell it to paper recyclers, if possible.

Recommendation 15
Return the undamaged drums to manufacturers

Recommendation 16
Consult with the national and provincial waste exchange centers for possible waste reuse

The following are the national and provincial waste exchange's addresses:

Dr. Bob Laughlin, Manager
Canadian Waste Material Exchange
Sheridan Park Research Community
Mississauga, Ontario
L5K 1B3; Tel (416) 822-4111

Mr. William C. Kay, Manager
Alberta Waste Materials Exchange
P.O. Box 8330, Postal Station F
Edmonton, Alberta
T6H 5X2; Tel (416) 450-5408

Waste exchange plays an important role in relaying waste from the generation point to the market. Recently the Ontario Waste Exchange was successful in matching 4 tonnes of waste latex materials with a manufacturer to use as a raw material.

Solvents may be obtained through Waste Exchange. For example, the microchip & printed electronic circuit board industry uses large quantity of ultra pure solvents. They are used once then must be discarded, yet they are still pure enough to meet most other industrial applications.

Recommendation 17
Consider switching from the solvent-based products to water-based.

Because of the increasing concerns over photochemical smogs and worker health in both paint formulation and applications the plant should consider switching its productions to water-based paints.

Recommendation 18
Repair or replace the mixture transfer pump which has a worn out seal or broken casting.

It was noticed during the field assessment that the pump was discharging a visible air-solvent mist into the operation room. It was evident that the loss of solvent was quite high.

Recommendation 19
Dyke the two thinner tanks

Wet thinner and dry thinner are held in two, above-ground undyked storage tanks, one holding 2000 gallons and the other 1000 gallons. Ideally, the dyke capacity should be 110% of stored volume.

Recommendation 20
Provide a communication and training program for employees

During the field assessment, it was noted that operators seemed indifferent to small quantity spills and solvent losses. For example, one of the operators spilled some solvent on the ground while rinsing a drum, but instead of cleaning it up he left it there to evaporate. While it was evaporating the solvent was stepped in and spread on the plant floor.

The following are possible training areas for employees:

- Hazardous material/waste handling
- Spill prevention and response
- Proper labeling of stored hazardous wastes
- Safety awareness
- Respirator use & other personal safety equipment
- First aid
- Process specific for waste reduction

4 SUMMARY AND CONCLUSIONS

The plant formulates its paints in a batch-type operation. Limited inventory checks are done on a daily basis. A complete inventory check is done once a year. No inventory is maintained for waste, such as used solvents. Bag filters have been properly reused. They are not considered to be toxic wastes if rinsed before discard.

In general, the plant has exercised equipment dedication to some extent, such as thin-down tanks and mobile mixing tanks and the use of light-to-dark product sequencing. Ball Mill No. 2 is used only for producing black paint. These measures help minimize waste generation. Spent solvent is used as a primer for the paint batches produced in the ball mill.

Recommendations based on the field waste audit have been presented to help improve the plant operation and waste management. These include maximizing equipment dedication and an inventory system, process modification and changes, the use of waste exchange, better housekeeping and staff training. They can be easily implemented without involving any sophisticated equipment.

PLANT B

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PLANT B

1 PLANT DESCRIPTION

This plant has been operating since 1976. Water-based paints are produced in a batch-type operation. Paints are blended with a white base and then tinted with other color bases to a desired shade. The plant floor layout includes three basic areas:

- Raw materials storage- liquid in drums
  - powder in bags
- Blending and thinning
- Filling and packaging
- Finished product storage and shipping

1.1 Raw Materials

The raw materials used include solvents, resins, pigments, extenders, bactericides and fungicides as shown in Table 1.

Water is used to disperse the resin binder and pigments into a homogenous mixture. Pigments, added in a dry form, provide paints with color and opacity to shield the resin binder from ultraviolet degradation. Resins are used for binding the pigments and film formation after water has evaporated. Extenders (fillers) are added to improve weathering properties, to furnish a base for the real pigment, and to prevent too rapid settling. Surfactants and defoamers serve as wetting agents to lower surface tension, to assist the dispersion of the pigments in the resins, and to produce a uniform film. In addition, defoamers help to avoid or minimize bubble formation during mixing, filling, or brush application. Glycols and alcohols are used as cosolvents to prevent excessively rapid water evaporation, which would result in a thick coating edge when brush applied. Bactericides and fungicides are added to water-based paints to prevent paints from contamination or degradation. Pigments are received in a dry form.

1.2 Inventory

The plant has a card inventory system for raw material and products. The inventory is checked three times a year. A computer has been installed and the plant management has expressed an interest in establishing a computerized inventory system.

1.3 Blending and Thinning Process

This plant blends its paints using a one-stage process by which the blending of components and the thinning of the mixture are carried out simultaneously in the same vessel. Fig. 1 shows that production begins at a high speed dispersion blender, where dry

additives (such as extenders, pigments, and viscosity modifiers) and water are mixed and dispersed for a specified time. The mixture may be further thinned with water to specification in the same tank before being pumped through a filter to a small holding and filling hopper. A high speed dispersion blender is a cylinder equipped with a rotating blade to disperse the powder stream. The plant has six dispersion tanks (Table 2).

A typical operation sequence is:

(1) Add Liquid A (confidential ingredients).
(2) Add Liquid B (confidential ingredients).
(3) Add powder pigment(s).
(4) High speed mixing.
(5) Add surfactant and defoamer.
(6) Stop mixing.
(7) Transfer mixture to filling and packaging line.
(8) Send product (in 4-liter cans) to storage room.

Table 1

Raw Materials Used in Plant B

Description	Material
Solvents	O.M.S. Aliphatics Methyl alcohol Propylene glycol Diethylene glycol Mineral spirit (hydrocarbon solvent) "Varsol"
Resins	Acrylics Oleoresinous binders Alkyd resins Vinyl-acrylics
Pigments	Titanium dioxide Yellow pigment (yellow oxide) Red pigment (containing red lead, Pb_3O_4) Other inorganic pigments Organic pigments
Extenders	Clay Calcium carbonate (whitening) Talc ($H_2Mg_3(SiO_3)_4$)
Miscellaneous additives	Bactericides & fungicides Surfactants and defoamers (wetting agent; hydrophilic) Viscosity modifiers Ammonia Drying oils

Table 2

Mixing/Dispersion Tanks- Plant B

Capacity (gallons)	Number of Tanks	Mobile	Stationary
125	2	x	
200	2	x	
250	2	x	

1.4 Filling and Packaging

After the ingredients have been blended and thinned to specifications, the mixture is transported to the filling and packaging line (Fig. 1). The plant has an automatic packaging line where cans are machine filled and pressure sealed.

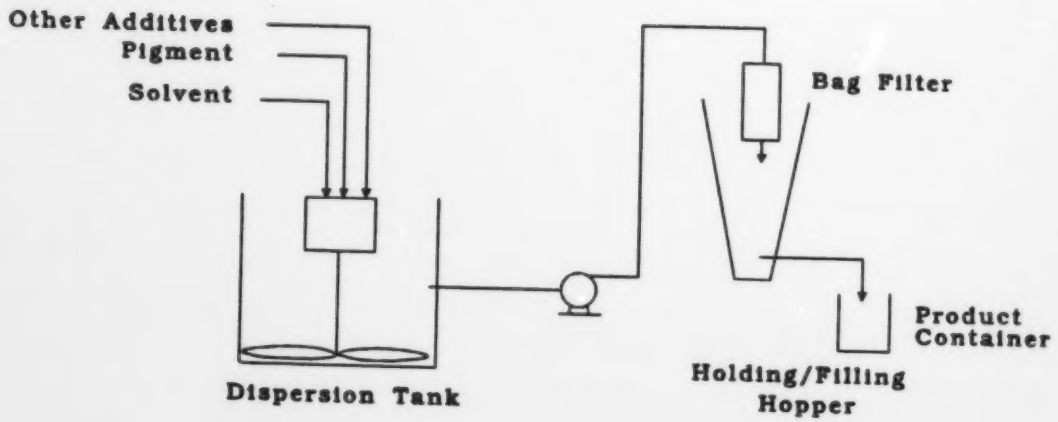

Fig. 1 A Schematic Flow Diagram of the Paint Formulation Process- Plant B

1.5 Cleaning Operations

Nylon bag filters are used for removing undispersed solids, skin, scale and other contaminant particles from the paints. The filters having a pore size equivalent to 325 mesh. Each filter costs about $2.00.

The process vessel is cleaned after each batch operation, normally at the end of the day. One batch is about 100 gallons. The container is first washed and rinsed with water, and then sanded down with a carbide sander. After the water wash and rinse, the spent water is saved to be blended with the next compatible batch.

2 WASTE TREATMENT AND DISPOSAL

Following are the major wastes from the plant:

- Damaged raw materials
- Paper packaging
- Empty drums
- Filters
- Paint sludge
- Rinsewater

Damaged raw materials are returned to their suppliers. Paper packaging is dumped in a garbage bin. Forty five gallon, cardboard drums are returned to the ingredient manufacturer. Bactericides come in small, square, soluble bags, which are dissolved in the paint mixture during the blending and thinning process.

Bag filters are replaced in the filling line for every batch (about every 2~3 weeks). They are not washed before being dumped in a garbage bin and finally taken away by a hauler to a landfill.

Paint sludge is put into a 250-gallon container and then solidified with cement prior to disposal in a landfill.

3 GENERAL OBSERVATIONS

(1) The plant staff indicated that they had never experienced any out-dated/excess materials.

(2) There were small drip collectors placed under the spigots of barrels.

(3) Floor drains are capable of diverting liquid to a 100-gallon sump to avoid discharging into the public sewer system.

(4) Inventory was kept to a minimum, thus avoiding any waste resulting from out-of-date raw materials.

(5) Brooms and collection equipment are stationed where pigments or dust are handled.

(6) Three 45-gallon drums containing sawdust were located near the mills and in the pigment handling areas. The sawdust could be used to absorb spilled liquid.

(7) A cyclone type dust collection system was installed over the pigment weighing area. The dust collected by the system was recycled.

(8) The plant is aware of Workplace Hazardous Material Information System (WHMIS) and is in the process of implementation.

4 RECOMMENDATIONS

Based on the foregoing information provided by the plant and that obtained from field assessments, the following suggestions are made to improve the plant operations to minimize waste generation. Rationales leading to some of the recommendations have been described immediately following the recommendations.

Recommendation 1
Exercise operational care

Effective measures for reducing waste from finished products and raw materials include:

- Safe, dry, storage area
- Care and attention in transport of raw materials from storage to point of use
- Care and attention in moving finished products to storage or to shipping point

Recommendation 2
Remove as much wet paint as possible by scraping before solvent-cleaning process vessels.

Recommendation 3
Avoid paint drying in process vessels.

It is desirable to avoid dry paint scaling by cleaning the vessel immediately after use, or adding a small quantity of water to the vessel. The latter needs some coordination between production and cleaning.

Recommendation 4
Use slurried pigments instead of powdered pigments

Dusts are generated when powder is sampled during weighing, or when added to a mixing vessel. The use of slurried pigments will avoid the problem. Slurried pigments may be purchased directly from manufacturers.

Recommendation 5
Document waste streams and their generation rates

Get to know when, what and how much waste is generated by each step of the process.

Recommendation 6
Contact waste exchange centers for possible waste reuse

Waste exchange plays an important role in relaying waste from the generation point to the market. Recently the Ontario Waste Exchange was successful in matching 4 tonnes of waste latex materials with a manufacturer that could use it as raw material.

Recommendation 7
Use high pressure spray cleaning.

High pressure spray cleaning systems are commercially available. The use of a high pressure spray cleaning system is more economical than solvent wash.

5 SUMMARY AND CONCLUSIONS

This plant is a small size, paint formulation shop making water-based paints. Various ingredients are first blended with titanium dioxide to produce white paint. The white paint may be further tinted with other dry pigment colors to give the desired shade.

The plant has installed a computer and expressed an interest in establishing a computerized inventory system for raw material and products. It is in the process of implementing the Workplace Hazardous Material Information System. Some measures have been taken to reduce its waste, such as the use of water soluble bags of bactericide, the use of bag filters instead of cartridge filters, the minimization of stock and the return of cardboard drums to the manufacturer.

Based on the field waste audit several recommendations have been presented to assist the plant in improving its waste management. These include better housekeeping, process modifications/operational changes, and waste exchange.

PLANT C

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PLANT C

1 PLANT DESCRIPTION

The major function of this plant is to blend different colored inks from the basic shades purchased from suppliers in Toronto. The plant formulates both water-based and solvent-based inks.

1.1 Raw Materials

Isopropyl alcohol is used for the cleaning of solvent-based operations, and water for water-based operations. Extenders (fillers) are used for improving weathering properties, furnishing a base for the real pigment and preventing too rapid settling. Pigments, resins and extenders are premixed into raw inks by their suppliers (Table 1). No bactericides are applied.

Table 1

Raw Materials Used in Plant C

Description	Material
Solvents	Aliphatics "Varsol"
Raw inks	Containing pigments, extenders and resins.
Pigments (already mixed into raw inks by supplier)	Titanium dioxide Yellow pigment (yellow oxide) Blue pigment Black pigment (containing carbon black)
Extenders (already mixed into raw inks by its supplier)	Clay Talc ($H_2Mg_3(SiO_3)_4$) Syloid
Miscellaneous additives	Bentonite slurry (viscosity modifier) Manganese and cobalt driers*

*used to aid in the crosslinking of unsaturated bonds in oleoresinous binders by acting as oxidation agents.

Table 2

Annual Ink Production- Plant C

Types of Inks	Annual Production (1988), Kg
Letter press ink	14,120
Lithographic or off-set inks	30,650
Flexographic inks	
-water base	15,020
-solvent base	14,690

1.2 Inventory

A computerized inventory system is used for raw material and product control. A complete inventory check is done twice a year. Informal inventory check is done every day to assess supply needs.

All excess material is put on sale to be used by other companies. No out-of-date chemicals have been encountered by the plant.

1.3 Workplace Hazardous Material Information System (WHMIS)

The plant manager is aware of WHMIS and is in the process of implementation. All the staff are trained and certified in WHIMS by their Toronto headquarters and by High Science of Toronto.

1.4 Ink Formulation Process

The plant has one 3-roller mill, one high speed disperser (HSD) and one chain and dough mixer.

Normally oil-based inks are subject to the roll mill after having been premixed by a HSD or a chain mixer to:

- Force the air out of the ink mixture, and
- Homogenize the ink mixture.

Components are added to the back of the mill and pressed and blended by the rear of two rollers. The mixture is then pushed to the front roller from which it exits the mill. If necessary, the product is fed back to the mill for further mixing and blending. It takes about 3 hours for a large batch production (about 200 kg); 10-15 minutes for a small one (under 12 kg). The finished products are manually put into the distribution containers, ready for sale.

A typical production path is as follows:

(1) weigh (each component).

(2) premix in a tub (for a large batch production).

(3) mix in a HSD or a chain & dough mixer

(for water-based inks go to Step 6)

(4) go through 3-roll mill (normally for oil-based inks).

(5) feed back effluent (in a paste form) to roll mill, if necessary.

(6) filter through wire screen (stainless steel strainers)

(7) product container

1.5 Filling and Packaging Line

The operator uses a knife to transfer ink from the roller mill into distribution containers, which are sealed by hand.

1.6 Cleaning Operations

The plant has many processing vessels of various sizes, such as 2~3, 150 and 200 gallons that require cleaning. Cleaning is often done after a light-to-dark production scheme to avoid unnecessary cleaning. Wet ink on the vessel walls (clingage) is dry-cleaned by manual scraping before solvent washing (for solvent-based inks) or water washing (water-based inks).

"Varsol" may be used for cleaning up spills of oil-based inks.

2 WASTE TREATMENT AND DISPOSAL

The major waste streams generated are as follows:

- Scraped off residue
- Spent solvents
- Sludge from spent solvent

o Cooling water

The scraped off residue is recycled/reused by blending with the next compatible batch. The spent solvent is stored in 45-gallon drums. There are 4 45-gallon drums of spent solvents accumulated over the last two years. They will be sent to the Alberta Special Waste Treatment Center for destruction at a cost of $165 per drum. In the past spent solvents were shipped to Sarnia, Ontario for disposal.

The amount of sludge resulting from spent solvent is minimal, and is put into the drums along with spent solvent for disposal.

The cooling water does not contain any chemicals, and is directly discharged into the municipal sewer system.

There is no waste paper packaging generated. Raw material drums are sent to Alberta Containers or returned to the raw material suppliers in Toronto.

The plant employs wire screen filters having a pore size of approximately 1~2 mm. These filters are washed and reused.

The plant makes inks using a light-to-dark production sequence, such as yellow-red-blue-brown-black, to reduce wastes.

3 GENERAL OBSERVATIONS

(1) Spillage and dust were evident in the storage area and blending area.

(2) Coffee cups were hung under the spigots of barrels. The spigots and coffee cups were further protected by placing 20-gallon pails underneath.

(3) The plant manager did not feel that they needed a spill contingency plan.

(4) The shipping/receiving supervisor has been trained and certified for TDGA regulated materials.

4 RECOMMENDATIONS

Recommendation 1
Inventory waste generation

This plant seems to maintain a good computerized inventory system for raw materials. It is suggested that the system be expanded to include wastes (such as, spent solvents) to document their sources and generation rates.

Recommendation 2
Consult with Labour Canada on the implementation of WHMIS and take the following four major steps to comply with WHMIS:

(1) Use the current inventory to give a profile of chemicals/toxic materials in the

workplace.

(2) Identify chemicals or products which are designated as controlled products under the federal Hazardous Product Act and provincial regulations.

(3) Obtain a current MSDS and a label for every controlled product or chemical in the workplace. A copy of the most current inventory and MSDS should be made available in the workplace so that the workers are aware of what is in use.

(4) Label every controlled product. A label may be a sign, a device, a stamp, a seal, a sticker, a ticket, a tag, or a wrapper. It should be applied to the container of every controlled product. If the controlled product is not in a container, a placard may be used as a substitute. WHMIS labels are available from local suppliers.

(5) Train all employees to ensure that they are familiar with the contents of WHIMS, MSDSs and labels; that they understand the procedures for safe use, storage, handling and disposal of each controlled product, and how to respond in an emergency situation.

Recommendation 3

Remove as much wet ink residues as possible by scraping before solvent or water cleaning process vessels.

To avoid ink drying in a process vessel, clean the vessel immediately after use, or add a small quantity of compatible solvent or water into the vessel. The latter needs some coordination between production and cleaning.

Recommendation 4

Use a high pressure spray cleaning system

High pressure spray cleaning systems are available commercially. The use of a high pressure spray cleaning system can be more economical than solvent wash.

Recommendation 5

Contact Waste Exchange for possible waste reuse, and/or explore solvent recovery instead of disposal.

Waste exchange plays an important role in relaying waste from the generation point to the market. Recently the Ontario Waste Exchange was successful in matching 4 tonnes of waste latex materials with a manufacturer that could use it.

It may be possible to obtain solvents through Waste Exchange. For example, the microchip & printed electronic circuit board industry uses large quantities of ultra pure solvents. They are used once, then must be discarded, yet they are still pure enough to meet most other industrial use specifications.

Commercial solvent recovery services are available, one such is Technisol Corporation (P.O. Box 1040, Raymond, Alberta, T0K 2S0; Tel (403) 752-4531; Fax (403) 752-4766.)

5 SUMMARY AND CONCLUSIONS

The major function of this plant is to formulate different colored inks from the basic shades. The plant makes both water-based and solvent-based inks.

The main raw materials used are raw inks with basic shades, driers and viscosity modifiers. Pigments and resins are already premixed into raw inks by their suppliers. The plant employs some measures that help reduce waste generation including the dry cleaning of wet inks on the vessel walls before either water-wash or solvent-wash, reuse of paint residue by blending into the next compatible batch, and the use of light-to-dark product sequencing.

Based on the field waste audit, five recommendations have been presented to the plant for achieving additional waste reduction. These include the expansion of the computerized inventory system to include wastes, implementation of WHMIS, maximization of dry cleaning, the use of a high pressure spray system, and expanded use of waste exchange and recycling. These measures can be easily implemented without the use of any sophisticated technology or large expenditures of money.